

Carbon Co. Lat/Long Address Proposal

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Proposal: Situs Addresses Based on Latitude and Longitude Benjamin B. Clement, Carbon County GIS
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According to Wikipedia, an address is "a code and abstract concept expressing a location on the earth's surface." Typically, each local governmental jurisdiction will assign a situs or physical address based on some system (usually either a grid or a distance from the origin of each road) which radiates out from a point of origin which is arbitrarily set by said authority. While there have been attempts to unify addressing systems, there have been so many competing systems created over the years that often arguments, pro and con, degrade into bickering about the perception of advantage between the different abstractions. Although this system of addressing has served us for many years, I propose that the unification of situs addressing based on a universal system we recognize as Latitude and Longitude is becoming necessary.

The problem.

Right now there is an ever increasing need to translate a traditional situs address into a physical location. Perhaps the most obvious or well known need is correlating the phone number from an emergency phone call with the location of the emergency as in E-911. Therefore, let's use E-911 as a basis for the discussion and branch out from there.

In the state of Utah, E-911 calls originating from a landline are rerouted to a central switch where the appropriate Public Safety Answering Point is determined. Also from there, the phone number is looked up in a large database and matched to its address if one exists. Emergency Service Numbers (numbers that tell dispatch which police, fire, and ambulance services should respond) are also tied to the phone number and then the phone number with all of the additional information is sent to the responsible dispatch center. Once there, the information is fed to a computer system, the address is stripped off, and a process called geocoding is applied to the address in an attempt to tie the address to a latitude longitude pair so that the computer can map the location of the incident.

While it may not be obvious from the above description, the problem with the process is in the geocoding. Without going too far into the technical details, geocoding is a process whereby each length of road from one intersection to another is added to a GIS database. A range of appropriate house numbers is assigned and an offset assumed. For purposes of illustration, if a section of Main Street from 100 East to 200 East in Anytown, USA were to be selected, a range of house numbers from 100 to 200 would be appropriate to that section. However, only odd house numbers would appear on one side while even numbers would normally be found on the opposing side. Therefore, two ranges of numbers (100 - 198 and 101 - 199) would need to be added to the segment of road; one for the right side and one for the left.

In practical use then, the GIS system knows the geographical location of the road centerline in question. So determining the latitude longitude pair for a given address along that road centerline involves the following steps:

- If the house number of 150 is supplied (for ease of explanation), the length of the road would be divided in half.
- Since the house number is even, the even side of the road would be ascertained.
- An offset distance from the road centerline would be applied.
- The GIS system would return the latitude longitude pair for the point located at the offset distance measured at right angles from the trend of the segment of road centerline at one half its length.

Most of the time, in town, this system works. But the keen-eyed will note that there are a few potential problems. First off, this system will match every number between 100 and 200 even though it is likely that there are at most four or five houses along each side of that particular segment of road. This greatly increases the chances of a false positive match. Next, there is the issue of the offset. In town, it usually works but if you are out in the country offsets could be a great deal longer, and the farther off the main road that a dwelling is, the more likely the entrance road is to meander instead of coming off at right angles. Now add to these issues the difficulties in dealing with mistakes made by the local officials when creating the address like odd-even transpositions, or in the case of offset intersections, 100 block addresses straight across the street from 200 block addresses, or even just skipping a block on a long country road such that you have an 800 block house number where a 900 one should be and the complexity of the geocoded addressing system grow quickly.

Additionally, with the advent of the cell phone, one can no longer make any assumptions about a call's point of origin as can be done with a land line. Geocoding is no longer applicable and so a new system had to be implemented. In this

case, it is really two variations on one system. A cell phone either supplies its location directly from GPS, or its location is triangulated from multiple cell towers. In either case, the final location is delivered in terms of latitude and longitude.

So if we must now deal with two systems and if geocoding is not able to deal with cell phones but latitude and longitude will work for both cell calls as well as landlines, the question that begs to be asked is, "Why not just unify on latitude and longitude?" I submit that there is no reason not to and that there are many more reasons to switch.

The benefits to changing.

The first benefit that I find to using latitude longitude pairs is accuracy. They are unambiguous. That does not mean that using them will be a panacea, but each pair can be found repeatedly and reliably. And once the data entry is found to be correct, it does not have to be revisited.

You might ask if that last point is not the same for the current geocoded system. To an extent, yes. But the current system is based on many separate addressing systems (eight systems in the case of Carbon County Utah for instance) which do not align with each other. So in the case of a city annexing from the county, all of those addresses within that annexation will have to be changed. Multiplied by the number of cities across the country one can quickly see that the problem is not trivial. Conversely, due to its universality, latitude longitude pairs would need no update regardless of changing boundaries.

Further, if the underpinnings of addresses themselves are based in a system that is intrinsically understood by the computer, no more interpretation. This would mean that location based services could be utilized directly.

Imagine with me for a moment that you are a UPS delivery driver. Imagine also that this is your first day on the job in an unfamiliar area. Normally these facts could be a recipe for a long day. But if everyone's address were based on latitude and longitude, and if that address were embedded on a barcode or RFID tag, as the truck was loaded, the onboard computer could be assembling a list of deliveries. Further, if a web service were available to that computer, a route connecting each delivery could be computed such that by the time the driver was strapped in and the truck started, turn by turn instructions could have already been assembled awaiting use. This is but one example of many that could be illustrated and it opens up the possibility of a great many more that have yet to be devised.

Finally, everyone with a GPS would be able to both determine and find an address based on latitude and longitude. This would open the addressing system up to inspection by many people from homeowners to delivery people and utility workers. Mistakes would be very apparent and would be likely to be found and reported quickly.

What would such an address look like?

In trying to decide which format of latitude and longitude to use, I found that there is a possible benefit inherent in using decimal degrees (DD) over decimal minutes (DM) or decimal minutes seconds (DMS). That is that at least in this part of the world, four decimal places will give enough spatial resolution to use for addressing in most cases. This provides for the use of four digits, a directional, four more digits and another directional as an address. This has the benefit of looking very similar to a traditional address. So, for purposes of illustration, the address for the Carbon County Courthouse would be 8087 N 5994 W. But what of the degrees? Well, if I tell you that the Courthouse is in Price, UT or even in the 84501 zip code, you can quickly find out which degrees to prepend to the address to make it work directly with either GPS or location-based web services. In this case, 39° and 110° respectively.

Why some will be against it.

The most common complaint about this system that I have heard to date is, "I have had my current address for years and I do not want to change." Changing an address system is a large undertaking. It will not happen overnight. The main benefits of changing the system will no doubt be realized by the generation growing up. To them, the changes that will confuse those established in the current system will become second nature. However, as that generation is in the minority right now, I believe that multiple systems will have to co-exist for some time into the future. To ease the transition and to accommodate those who are resistant, a web service could be created to act as a lookup table or cross reference between types of addresses. Although it complicates the transition, I find it to be necessary both to gain acceptance and to effect the smoothest conversion. However, for the sake of clarity, I advocate the exclusive use of latitude longitude pairs for E-911 and for all official documents requiring a situs address (i.e. recorded documents such as deeds, etc).

In summary.

With the advent of location based/aware services, we are faced as a society with an ever broadening mandate to translate addresses into something that computer systems understand natively. The more we translate, the more we subject ourselves to error.

Moving to a system that the computer understands directly would result in increased accuracy, constancy and simplicity and the ubiquity of navigational technology such as the GPS makes the move possible.

Even if everyone were to adopt latitude and longitude for addresses tomorrow, we would not be done. The system will still need to evolve just to keep up with changes that are on the horizon such as allowing the use of cell phones in flight. We will need to carefully consider how to move to a true three dimensional representation of everyday life, but I feel that using latitude and longitude will allow us the requisite flexibility.